Anjuman-I-Islam's
Kalsekar Technical Campus

A PROJECT REPORT

Digital Image Watermarking In Transform Domain

Submitted by

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Under the guidance of

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At

Anjuman-I-Islam's Kalsekar Technical Campus

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Submitted by

SAMEER MALIM (13ET31)

in partial fulfillment for the award of the degree

of

B.E

IN

ELECTRONICS & TELECOMMUNICATION

At

ANJUMAN-I-ISLAM'S

KALSEKAR TECHNICAL CAMPUS, PANVEL

MARCH 2017

Project Report Approval for B.E

This project report entitled 'Digital Image Watermarking In Transform Domain' a project initiative by **Sameer Malim,** is approved for the degree of Bachelor in Engineering.

Supervisor: Guide:

_____ _____

Prof. Mujib Tamboli **Prof. Shahin Athavani**

(H.O.D, EXTC) (Asst Prof, AIKTC)

External:

_____

Date :

Place :

DECLARATION

We, hereby declare that the project entitled "**Digital Image Watermarking In Transform Domain"** submitted for Degree of Bachelor in Engineering is our original work and the project has not formed the basis for the award of any degree, associate ship, fellowship or any other similar titles. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our opinion.

Mr.Sameer Malim _____

Place: New Panvel

Date: 28th March, 2017

ACKNOWLEGDEMENT

We appreciate the beauty of a rainbow, but never do we think that we need both the sun and the rain to make its colour appear. Similarly, this project work is a fruit of many such unseen hands.

A special gratitude to the honorable chairman Dr Burhan Haris Sir and honorable director Dr Abdul Razzak Honnutagi Sir for allowing me to this project.

We are using this opportunity to express our gratitude to everyone, who supported us throughout the project. We are deeply grateful to Prof. Mujib Tamboli (H.O.D EXTC), for providing us the opportunity to carry out the project.

A special gratitude we give to our Project Guide Mrs.Shahin Athavani , whose contribution in stimulating suggestions & encouragements helped us in the completion of the same.

I express my gratitude to all teaching and non teaching faculty who helped me directly or indirectly to make the project happen.

We perceive this opportunity as a big milestone in our career development, we will strive to use the gained skills & knowledge in the best possible ways & continue to work on their improvement in order to attain the desire career objective.

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Abstract

Visual Cryptographic methods are not sufficient to solve all image security related issues. Watermarking is the art of hiding secret image in ways that prevent the detection of hidden images. Multimedia documents are very easy to copy and distribute in an illicit manner. Copyright labelling is a process that may help to reduce their illicit copying. If this document is copied the copy will also contain the label. This label (or watermark) should be robust enough to withstand normal image processing activities (like image compression, transforming to different format) that do not significantly alter the image appearance. In fractal image compression the encoding step is computationally expensive, because every range block must be compared to all domain blocks in the codebook to find the best-matched one during the coding procedure.

In this paper, a fast fractal encoding algorithm is proposed. Simulation results show that the runtime of the proposed algorithm is reduced greatly compared to the existing methods. At the same time, the new algorithm also achieved high compression ratio.

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LIST OF ABBREVIATIONS

DCT-Discrete Cosine Transform

DFT-Discrete Fourier Transform

GUI-Graphical User Interface

JPEG-Joint Photographic Expert Group

LL-Low Level

LH-Low High

HL-High Low

HH-High High

PSNR-Peak Signal To Noise Ratio

SVD-Singular Value Decomposition

www -World Wide Web

PROJECT OVERVIEW

Introduction

Digital watermarking is a technology for embedding various types of information in digital content. In general, information for protecting copyrights and proving the validity of data is embedded as a watermark. A digital watermark is a digital signal or pattern inserted into digital content. The digital content could be a still image, an audio clip, a video clip, a text document, or some form of digital data that the creator or owner would like to protect. The main purpose of the watermark is to identify who the owner of the digital data is, but it can also identify the intended recipient.

The DCT allows an image to be broken up into different frequency bands, making it much easier to embed watermarking information into the middle frequency bands of an image. It has become easy to connect to the Internet from home computers and obtain or provide various information using the World Wide Web (WWW). All the information handled on the Internet is provided as digital content. Such digital content can be easily copied in a way that makes the new file indistinguishable from the original. Then the content can be reproduced in large quantities.

For example, if paper bank notes or stock certificates could be easily copied and used, trust in their authenticity would greatly be reduced, resulting in a big loss. To prevent this, currencies and stock certificates contain watermarks. These watermarks are one of the methods for preventing counterfeit and illegal use. Digital watermarks apply a similar method to digital content. Watermarked content can prove its origin, thereby protecting copyright. A watermark also discourages piracy by silently and psychologically deterring criminals from making illegal copies.

Modules and Description

In the proposed system, there are four modules, they are as follows:

1. **Embedding secondary watermark into primary:**
   - In two-dimensional DCT, each level of decomposition produces four bands of data denoted by LL, HL, LH, and HH. The LL sub band can further be decomposed to obtain another level of decomposition. This process is continued until the desired number of levels determined by the application is reached. In DCT based watermarking, the singular values of the detail and approximate coefficients are extracted. The extracted singular values are modified to embed the watermark data.

2. **Encryption of watermarked primary image and embedding in the host image:**
   - Chaos theory is a branch of mathematics which studies the behavior of certain dynamical systems that may be highly sensitive to initial conditions. This sensitivity is popularly referred to as the butterfly effect. As a result of this sensitivity, which manifests itself as an exponential growth of error, the behavior of chaotic systems appears to be random. That is, tiny differences in the starting state of the system can lead to enormous differences in the final state of the system even over fairly small timescales. This gives the impression that the system is behaving randomly. Chaos-based image encryption techniques are very useful for protecting the contents of digital images and videos. They use traditional block cipher principles known as chaos confusion, pixel diffusion and number of rounds.

     The complex structure of the traditional block ciphers makes them unsuitable for real-time encryption of digital images and videos. Real-

time applications require fast algorithms with acceptable security strengths. The chaotic maps have many fundamental properties such as ergodicity, mixing property and sensitivity to initial condition/system parameter and which can be considered analogous to some cryptographic properties of ideal ciphers such as confusion, diffusion, balance property. A chaos-based image encryption system based on logistic map, in the framework of stream cipher architecture, is proposed. This provides an efficient and secure way for image encryption and transmission.

3. **Attacks:**
   - To investigate the robustness of the algorithm, the watermarked image is attacked by Average and Mean Filtering, JPEG and JPEG2000 compression, Gaussian noise addition, Resize, Rotation and Cropping. After these attacks on the watermarked image, we compare the extracted watermarks with the original one. The watermarked image quality is measured using PSNR (Peak Signal to Noise Ratio).

4. **Extraction of primary and secondary watermark from the host image:**
   - Decryption is the reverse iteration of encryption. After decryption of the watermarked primary image, the extraction process takes place. Extracting Primary Watermark, the extraction technique for primary watermark is given as follows:

     a. Perform 1-level wavelet transform on the host and the watermarked image. Denote each sub-band with WK and WK for host and watermarked image respectively where K _ {LL, LH, HL, HH} represents the orientation.

b. The detail and approximation sub-images of the host as well as watermarked image is segmented into non overlapping rectangles.
c. Perform SVD transform on all non-overlapping rectangles of both images.

CHAPTER 2

LITERATURE SURVEY

SR NO	Title	Author	Year	Abstract	Workdone
1.	A DCT-domain system for robust image watermarking	Mauro Barni, Franco Bartolini, Vito Cappellini, Alessandro Piva	21st November 1997	Digital watermarking has been proposed as a solution to the problem of copyright protection of multimedia data in a networked environment. In this paper a new watermarking algorithm for digital images is presented: the method, which operates in the frequency domain, embeds a pseudo-random sequence of realnumbers in a selected set of DCT coe¦cients.	In this paper a watermarking algorithm for digital images operating in the frequency domain is presented: a pseudo-random sequence of real numbers having normal distribution with zero mean and unity variance is embedded in a selected set of DCT coe¦cients.
2.	Digital Watermarking of Multimedia Objects for Buyer Authentication	Dipti Prasad Mukherjee, Subhamoy Maitra, Scott T. Acton	Febrauary 2004	This paper presents an invisible spatial domain watermark insertion algorithm for which we show that the watermark can be recovered, even if the attacker tries to manipulate the watermark with the knowledge of the watermarking process	We have proposed a novel watermarking technique that survives attacks both in frequency and spatial domains. The strength of the algorithm is demonstrated through survival of the proposed watermark after Stirmark and JPEG compression Attacks.
3.	Watermarking of Digital Images in Frequency Domain	Sami E. I. Baba, Lala Z. Krikor, Thawar Arif, Zyad Shaaban	7th Febrauary 2010	Invisible watermarking methods have been applied in frequency domains, trying to embed a small image inside a large original image. The original bitmap image will be converted into frequency domain to obtain the discrete cosine transform (DCT) matrices from its blocks.	In this paper, we described a new approach based on DCT digital image water marking, which was done by embedding a watermark logo (image) in di®erent color components as well as semi-random image blocks.
4.	A Watermarking Technique based on the Frequency Domain	Huang-Chi Chen, Yu-Wen Chang, Rey-Chue Hwang	1st Febrauary 2012	A watermarking technique based on the frequency domain is presented in this paper. The one of the basic demands for the robustness in the watermarking mechanism should be able to dispute the JPEG attack since the JPEG is a usually file format for transmitting the digital	The two watermarking schemes presented in this paper operate in the spatial domain and are thus simple and computationally efficient. Both proposals behave well in front of compression and low-pass filtering.

				content on the network	
5.	Digital Image Watermarking Technique Using Discrete Wavelet Transform And Discrete Cosine Transform	Bhupendra Ram, *Member*, *IEEE*	April 2013	In this paper a new watermarking technique to add a code to digital images is presented: the method operates in the frequency domain embedding a pseudo-random sequence of real numbers in a selected set of DCT coefficient. And a new method for digital image watermarking which does not require the original image for watermark detection.	In this dissertation, a digital image watermarking technique based on discrete wavelet transform and discrete cosine transform has been presented, where the method operates in the frequency domain embedding a pseudo-random sequence of real numbers in a selected set of DCT coefficients
6.	HYBRID WATERMARKING OF COLOR IMAGES USING DCTWAVELET,	H. B. Kekre, Tanuja Sarode, Shachi Natu	May 2013	This paper presents a technique of digital image watermarking using DCT wavelet transform. Use of Haar wavelet is very common in watermarking. However, here DCT wavelet transform of size 256*256 is generated using existing well known orthogonal transform DCT of dimension 128*128 and 2*2. This DCT Wavelet transform is used in combination with the orthogonal transform DCT and SVD to increase the robustness of watermarking	Use of DCT-wavelet considerably improves the performance of watermarking as compared to use of Haar wavelet functions. It has been proved near about twice better in both aspects imperceptibility and robustness. Selection of appropriate value of scaling factor (K) also plays important role in proposed watermarking scheme
7.	Digital Watermarking Technique using Discrete Cosine Transform	Mrs. Deepati Agrawal, Mr. Vikas Gupta, Mr. Gaurav Mehta	June 2013	This paper proposes a watermarking algorithm based on image segmentation and discrete cosine transform (DCT). The image is first segmented and then for each segment, the image segment is subdivided into pixels blocks of size 8×8 (64pixels), and zigzag reordered. The DCT of the block is then computed.	To conclude, we have presented a new robust watermarking scheme. The results of experiments show that this approach is very promising, because it is robust to common image processing distortions

8.	Analysis and Survey of Digital Watermarking Techniques	Monika Patel, Priti Srinivas, Sajja Ravi K. Sheth	10th October 2013	The growth of the Internet along with the increasing availability of multimedia applications has produced a number of copyright issues. The digital data can be duplicated and edited with great ease which has led to a need for effective copyright protection tools. One of the areas that this growth has fueled is that of digital watermarking. Digital watermarking is the general technique of embedding some information in the original file, such that an altered file is obtained.	In this paper we have presented various aspects for digital watermarking like overview, history, working principle, classification, applications and techniques. Apart from it a brief and comparative analysis of watermarking techniques is presented with their advantages and disadvantages. In this paper we tried to give the complete information about the digital watermarking which will help the new researchers to get the maximum knowledge in this domain
9.	Digital Image Watermarking Using The Discrete Cosine Transform	Wahyu Prakosa Adi & Volker Müller		We describe an image watermarking algorithm that uses the Discrete Cosine Transform together with a cryptographic hash function to embed copyright information of limited size into an image.	We describe an image watermarking algorithm which makes use of the DCT transform and the MD5 cryptographic hash function together with an error correcting code

Goal of Project

A full realization of this concept would involve a few distinct steps.

First, setup the PC/Laptop environment for MATLAB to proceed with project development.

Second, to begin with development of the project and start creating the GUI (Graphical User Interface).

Third, to begin with core coding part with mathematical calculations, Logical calculation and Algorithm deployment.

Forth, to keep the system under maintenance by continuously testing the developed project till zero error and to make the system bug free.

Realization

As a full realization of this concept is beyond the time and budgetary constraints of this project, we plan instead to prove the concept by designing a demonstration project that will operate as a scaled down version of the above system. The aim of this project then, is to prove the concept of Watermarking by developing an algorithm to encrypt the image using DCT.

The proposed algorithm is demonstrated using MATLAB. We have taken 8-bit gray scale tree image as host image of size 256 x 256 and for primary and secondary watermark, we have used 8-bit gray scale image and boy image of sizes 128 × 128 and 64 × 64 respectively. The secondary watermark is embedded into primary and the watermarked primary is encrypted. For encryption, chaos encryption technique is used. For embedding the encrypted watermarked primary into the host image, we have used 2-level of decomposition using Daubechies filter bank. For extracting both the watermarks, decryption is done using the chaos technique. The decrypted image is then used to extract the primary watermark and this is used for extracting the secondary watermark. In figures 2 and 3 all original, watermarked images and extracted watermarks are shown. To investigate the robustness of the algorithm, the watermarked image is attacked by Average and Median Filtering, Gaussian noise addition, Resize and Rotation. After these attacks on the watermarked image, we compare the extracted watermarks with the original one.

Project Objectives

1. To improves the robustness and imperceptibility
2. To optimize the extraction of watermark of attacked images.
3. To demonstrate successful use of multiple scaling factors to achieve best results.

CHAPTER 3

Existing System & Proposed System

❖ Problem with current scenario

Many researchers implemented the SVD based watermarking in different domains like DFT and DWT etc. Domain change help in imperceptibility and robustness but it did not help in false positive issue. So many solutions of this false positive problem are given by different researchers. These suggestions include use of secret signature information generated by hash function, insertion of complete watermark, encryption of watermark before insertion, insertion of principal components of watermark etc. The use of signature method did not able to provide a complete security to the scheme as the signature was itself vulnerable to different attacks. The insertion of complete watermark provided complete security but the drawback was a poor capacity.

Proposed System

Digital watermarking is applicable to any type of digital content, including still images, animation, and audio data. It is easy to embed watermarks in material that has a comparatively high redundancy level ("wasted"), such as colour still images, animation, and audio data; however, it is difficult to embed watermarks in material with a low redundancy level, such as black-and-white still images. To solve this problem, we developed a technique for embedding digital watermarks in black-and-white still images and a software application that can effectively embed and detect digital watermarks.

It is important to overlay the watermark in a way which makes it difficult to remove, if the goal of indicating property rights is to be achieved.

***Invisible watermarking*:** An invisible watermark is an overlaid image which cannot be seen, but which can be detected algorithmically. Different applications of this technology call for two very different types of invisible watermarks:

A watermark which is destroyed when the image is manipulated digitally in any way may be useful in proving authenticity of an image. If the watermark is still intact, then the image has not been "doctored." If the watermark has been destroyed, then the image has been tampered with. Such a technology might be important, for example, in admitting digital images as evidence in court.

An invisible watermark which is very resistant to destruction under any image manipulation might be useful in verifying ownership of an image suspected of misappropriation. Digital detection of the watermark would indicate the source of the image.

Structure of a digital watermark

The structure of a digital watermark is shown in the following

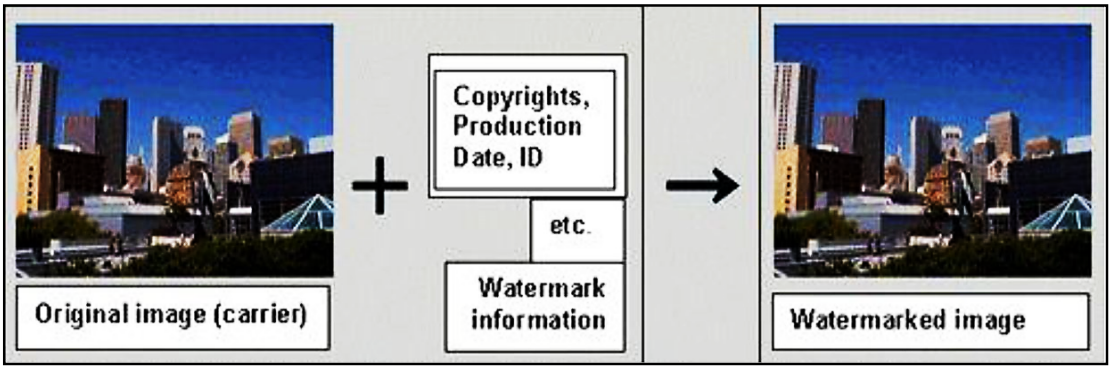


Fig. The Process of Hiding Watermark

Methodologies

This method provides high security for watermarks because of the encryption of watermark. It also increases the embedding capacity of a watermark because of the use a watermark.

In this project, we adopted the spatial domain by using the least significant bit to hide information in digital images.

❖ **Watermark Embedding Algorithm**

The algorithm for hiding the watermark is as follows:

➢ **Input:**

Watermark 1 – A binary image (the first watermark).

Cover Image – Color image to be watermarked.

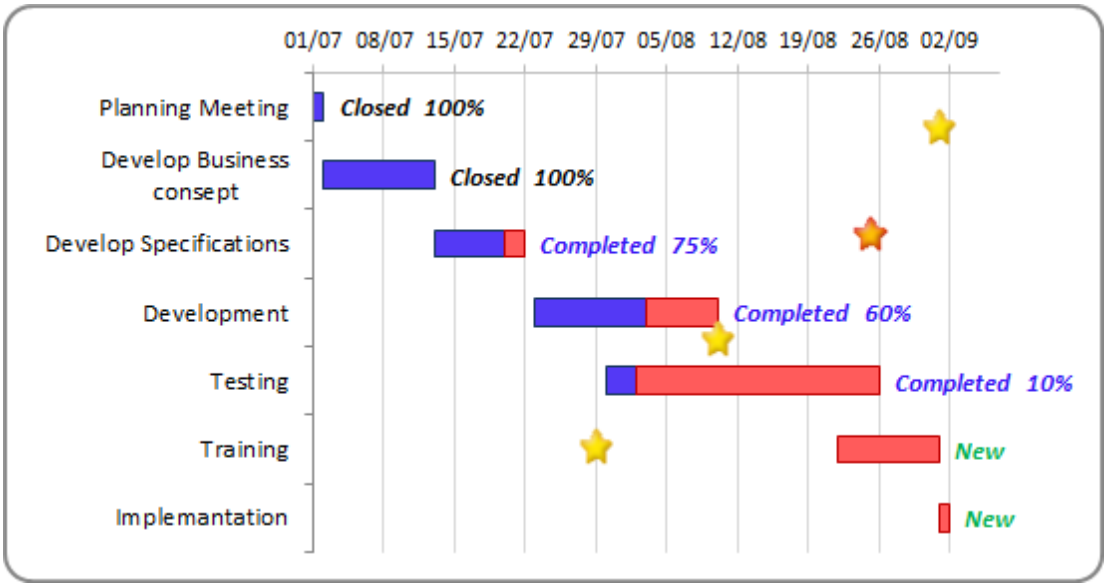
K1 – key1: Used for encrypting Watermark.

K2 – key2: Used for signature.

➢ **Output:**

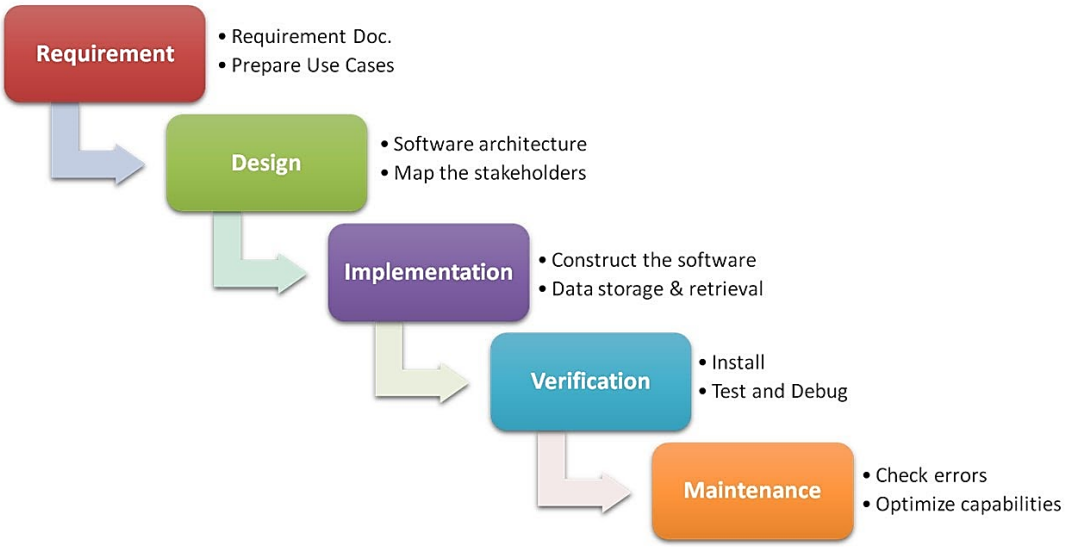
Watermarked – Final watermarked image.

Gantt Chart


01/07 08/07 15/07 22/07 29/07 05/08 12/08 19/08 26/08 02/09
Planning Meeting
Closed 100%
Develop Business consept
Closed 100%
Develop Specifications
Completed 75%
Development
Completed 60%
Testing
Completed 10%
Training
New
Implemantation
New

Project Lifecycle Details

Waterfall Model



Description

The waterfall Model is a linear sequential flow. In which progress is seen as flowing steadily downwards (like a waterfall) through the phases of software implementation. This means that any phase in the development process begins only if the previous phase is complete. The waterfall approach does not define the process to go back to the previous phase to handle changes in requirement. The waterfall approach is the earliest approach that was used for software development.

Database

Image classification or categorization has often been treated as a preprocessing step for speeding-up image retrieval in large databases and improving accuracy, or for performing automatic image annotation.

Image categorization is often followed by a step of similarity measurement, restricted to those images in a large database that belong to the same visual class as predicted for the query.

Database is constructed when the image each pixel value need to be stored. It creates a dataset to store the image information such as color value.

Database Design

Each entry in the database is designed to correspond to a single command utterance. The entries in the database were designed to be a feature matrix containing features extracted from the pre-recorded samples. There was one entry for all the pre-recorded commands.

Database construction

The entries in the database correspond to image values. The entries are in form of feature matrices extracted from the image file inputted by the user. The formation of the feature matrices is summarized in ‘Feature Extraction’.

CHAPTER 4

Project Implementation

The Project is loaded in MATLAB. We used **MATLAB R2013a** for Design and coding of project.

Project Implementation Tools

❖ Hardware Requirement:

- i3 Processor Based Computer or higher
- Memory: 1 GB RAM
- Hard Drive: 50 GB
- Monitor

❖ Software Requirement:

- MATLAB Version R2013a
- Operating system: Windows 7 and above

Overview of Technologies Used

1.1 Introduction

The tutorials are independent of the rest of the document. The primarily objective is to help you learn quickly the first steps. The emphasis here is "learning by doing". Therefore, the best way to learn is by trying it yourself. Working through the examples will give you a feel for the way that MATLAB operates. In this introduction we will describe how MATLAB handles simple numerical expressions and mathematical formulas. The name MATLAB stands for "**MATrix LABoratory**". **MATLAB** was written originally to provide easy access to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects. MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming environment. Furthermore, MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming. These factors make MATLAB an excellent tool for teaching and research. MATLAB has many advantages compared to conventional computer languages (e.g., C, FORTRAN) for solving technical problems. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. The software package has been commercially available since 1984 and is now considered as a standard tool at most universities and industries worldwide. It has powerful built-in routines that enable a very wide variety of computations. It also has easy to use graphics commands that make the visualization of results immediately available. Specific applications are collected in packages referred to as toolbox. There are toolboxes for

signal processing, symbolic computation, control theory, simulation, optimization, and several other fields of applied science and engineering.

1.2 Basic features

As we mentioned earlier, the following tutorial lessons are designed to get you started quickly in MATLAB. The lessons are intended to make you familiar with the basics of MATLAB. We urge you to complete the exercises given at the end of each lesson.

1.3 A minimum MATLAB session

The goal of this minimum session (also called starting and exiting sessions) is to learn the first steps:

- How to log on
- Invoke MATLAB
- Do a few simple calculations
- How to quit MATLAB

1.3.1 Starting MATLAB

After logging into your account, you can enter MATLAB by double-clicking on the MATLAB shortcut icon (MATLAB Version x) on your Windows desktop. When you start MATLAB, a special window called the MATLAB desktop appears. The desktop is a window that contains other windows. The major tools within or accessible from the desktop are:

- The Command Window
- The Command History
- The Workspace
- The Current Directory

- The Help Browser
- The Start button

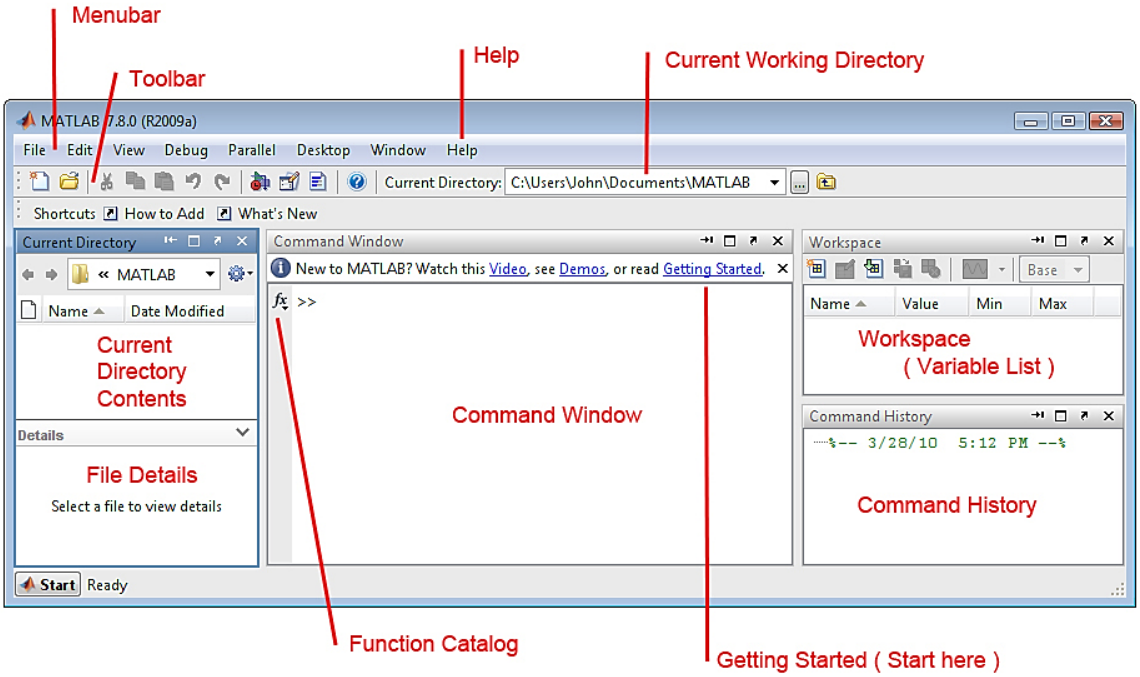


FIG: The graphical interface to the MATLAB workspace

When MATLAB is started for the first time, the screen looks like the one that shown in the above Figure. This illustration also shows the default configuration of the MATLAB desktop. You can customize the arrangement of tools and documents to suit your needs. Now, we are interested in doing some simple calculations. We will assume that you have sufficient understanding of your computer under which MATLAB is being run. You are now faced with the MATLAB desktop on your computer, which contains the prompt (>>) in the Command Window. Usually, there are 2 types of prompt:

>> **for full version**

EDU> **for educational version**

Note: To simplify the notation, we will use this prompt, >>, as a standard prompt sign, though our MATLAB version is for educational purpose.

Table 1.2: Hierarchy of arithmetic operations

Precedence	Mathematical operations
First	The contents of all parentheses are evaluated first, from the innermost parentheses and working outward.
Second	All exponentials are evaluated, working from left to right.
Third	All multiplications and divisions are evaluated, working from left to right.
Fourth	All additions and subtractions are evaluated, starting from left to right.

Encoding Algorithm

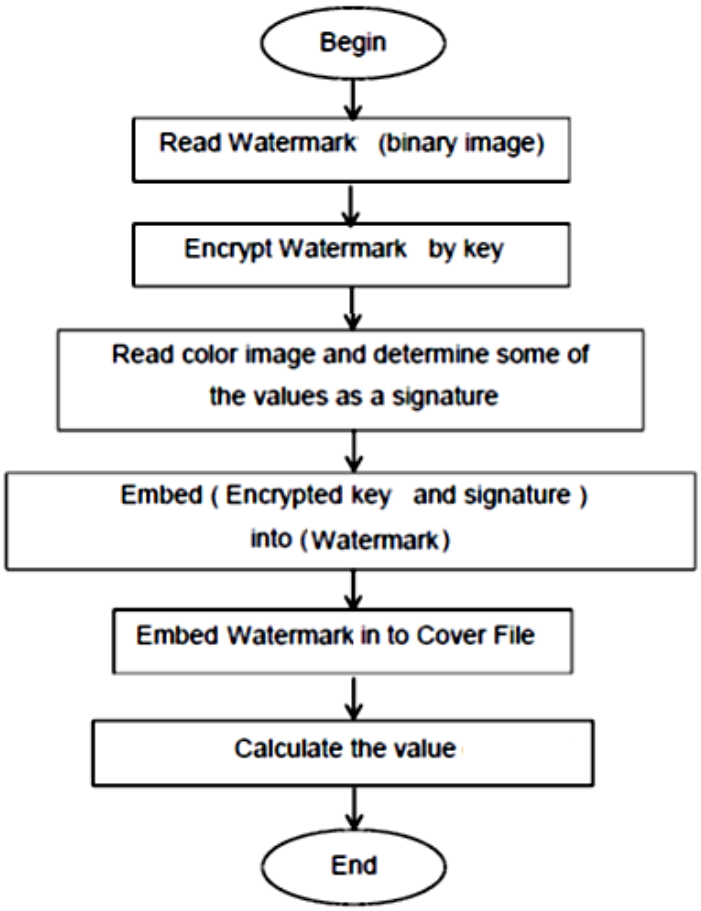


Fig. The Process of Hiding of Watermark

Decoding Algorithm

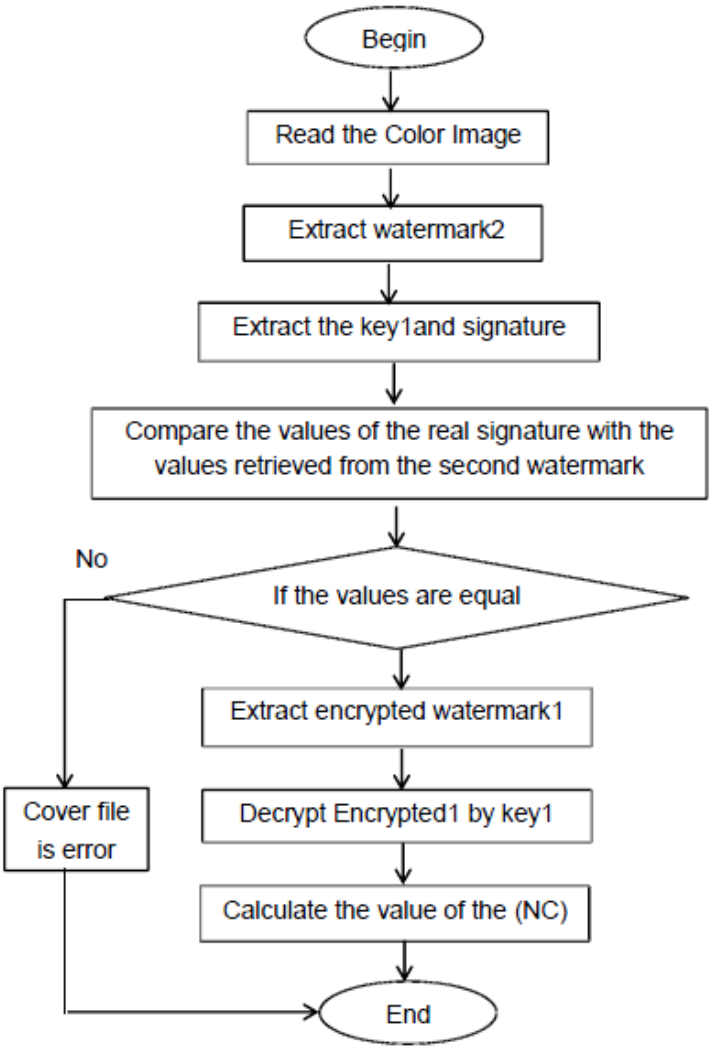
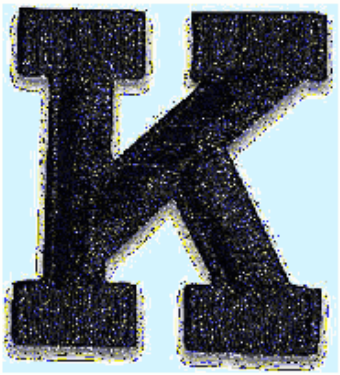


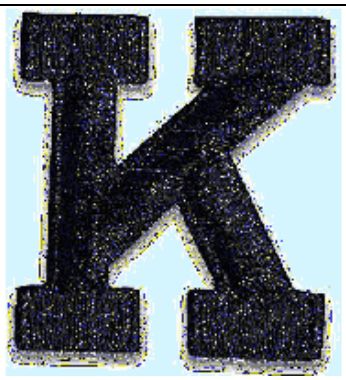
Fig. The Process of Extraction of Watermark

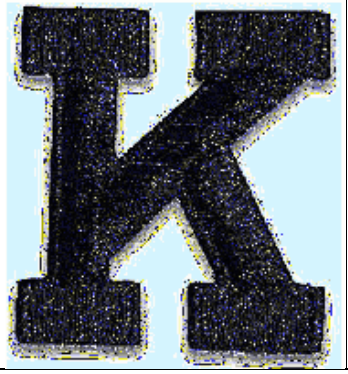
Result

DIGITAL WATERMARKING USING DCT

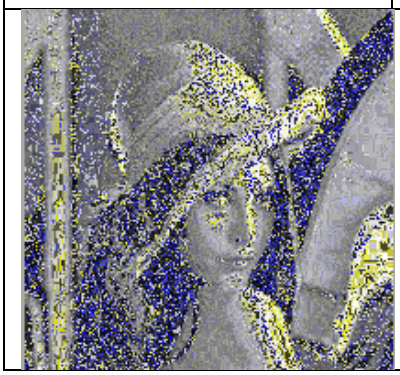
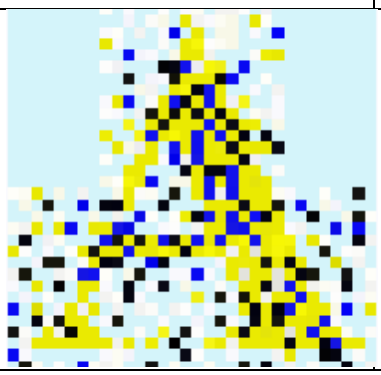
For Colour Image

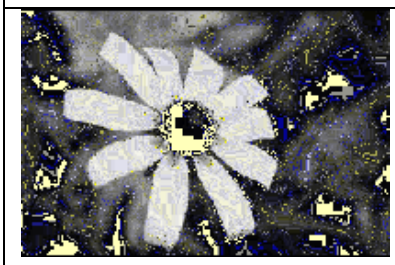
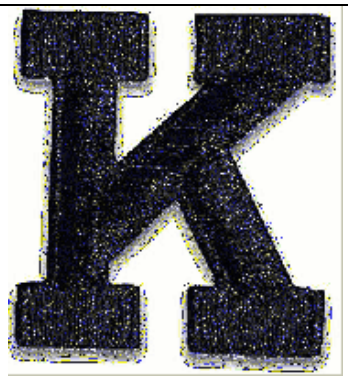
UPLOAD IMAGE	PSNR	HOST IMAGE	CORRELATION
	41.2869		0.997605

UPLOAD IMAGE	PSNR	HOST IMAGE	CORRELATION
	41.4788		0.995849

UPLOAD IMAGE	PSNR	HOST IMAGE	CORRELATION
	**40.8804**		**0.996044**

For Black and White

UPLOAD IMAGE	PSNR	HOST IMAGE	CORRELATION
	**41.4625**		**0.995585**

UPLOAD IMAGE	PSNR	HOST IMAGE	CORRELATION
	**41.4775**		**0.999598**

CHAPTER 5

Advantages of Project

- This system provides high security for watermarks because of the encryption of watermark.
- It also increases the embedding capacity of a watermark because of the use a watermark.
- Embedded the secret key into the watermark for more safety.

Disadvantages:

- System works only with image files.

Application:

This application can be used when user wants to send a secret message using an image file

System Features

1) Load Balancing:

Since the system will be available only the admin logs in the amount of load on server will be limited to time period of admin access.

2) Easy Accessibility:

Records can be easily accessed and store and other information respectively.

3) User Friendly:

The system will be giving a very user friendly approach for all user.

4) Efficient and reliable:

Maintaining the all secured and database on the server which will be accessible according the user requirement without any maintenance cost will be a very efficient as compared to storing all the customer data on the spreadsheet or in physically in the record books.

5) Easy maintenance:

Watermarking project is design as easy way. So maintenance is also easy.

Future Research

The scope of this project is in copyright protection systems, which are intended to prevent unauthorized copying of digital media. In this use, a copy device retrieves the watermark from the signal before making a copy; the device makes a decision whether to copy or not, depending on the contents of the watermark. Another scope is in source tracing.

Conclusion

In this project, Watermarking based on DCT and Fractal compression on the colour image is proposed. This proposed method is expected to work satisfactorily on colour image. This method consists of two phase. In the first phase, watermarking using DCT is carried out. In this phase, first input image is divided number of equal block, calculate the DCT transform coefficients, then select DC components of each block and finally embed the secret image pixels in each image. In the second phase, Fractal compression is carried out. In this, input image is divided into equal size of square blocks, determine which larger block has the lowest difference and calculate a grayscale transform to match intensity levels between large block and child block. Finally, image is compressed. The runtime of the proposed algorithm is reduced greatly. At the same time new algorithm achieved high compression ratio

CHAPTER 6

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